202301UECM2453OE4b

Start again

Review of preview

Started on	Sunday, 16 April 2023, 04:18 PM
Completed on	Sunday, 16 April 2023, 04:18 PM
Time taken	10 secs
Grade	**0** out of a maximum of 10 (**0**%)

1

Marks: 1

You are given the following information for zero-coupon bonds:

Bond Maturity (T in years)	1	2	3	4
P(0,T)	0.9559	0.8405	0.7673	0.7006
1-year Forward Price Volatility for a Bond Maturing at T	(N/A)	0.101	0.108	0.113

Calculate the price of an interest rate caplet that provides an 11.0% (effective annual rate) cap on 1-year borrowing of 100 3 years from now. _____

Answer:

✗

Make comment or override grade

Incorrect
Correct answer: 5.6499

Marks for this submission: 0/1.

2

Marks: 1

Let P(r,t,T) be the time-t price of a zero-coupon bond that matures at time T, when the time-t short rate is r. You are given:

- The stochastic process of P is given by

$$dP(r,t,T) = \alpha(r,t,T)P(r,t,T)dt - q(r,t,T)P(r,t,T)dZ(t),$$

  where Z(t) is a standard Brownian motion.
- The Sharpe ratio of the interest rate risk is of the form $\varphi(r,t) = kr$, where k is a constant.
- $\alpha(0.15,2,5) = 0.65$
- $q(0.15,2,5) = 2.38$ and $q(0.24,3,7) = 3.87$

Determine $\alpha(0.24,3,7)$. _____

Answer:

✗

Make comment or override grade

Incorrect
Correct answer: 1.54088

Marks for this submission: 0/1.

3

Marks: 1

You are given:

- The stochastic process of the short rate is

$$dr(t) = a(r)dt + \sigma(r)dZ(t),$$

  where $\sigma(r)>0$ and Z(t) is a standard Brownian motion.
- Let P(r,t,T) be the time-t price of a zero-coupon bond that matures at time T, when the time-t short rate is r. Then P(r,t,T) satisfies the equation

$$\partial P/\partial t + (0.43 - 0.22r)\,\partial P/\partial r + 0.058r\,\partial^2 P/\partial r^2 = rP$$

- The Sharpe ratio is $\varphi(r,t) = 0.1\sqrt{r}$.

Determine a(0.07). _____

Answer:

Make comment or override grade

Incorrect
Correct answer: 0.41222
Marks for this submission: 0/1.

4
Marks: 1

For $t \le T$, let P(r, t,T) be the price at time t of a zero-coupon bond that pays $1 at time T, if the short-rate at time t is r. You are given:

- $P(r, t,T)= A(t,T)e^{-B(t,T)r}$ for some functions A(t,T) and B(t,T).
- B(0,8)= 3.0667.

Based on P(0.043, 0, 8), you use the delta-gamma approximation to estimate P(r, 0, 8), and denote the value as $P_{Est}(r, 0, 8)$. If $1000(P_{Est}(r, 0, 8)/P(0.043, 0, 8)-1)= -15.2463$ and $r < 0.1$. Calculate r. _____

Answer:

Make comment or override grade

Incorrect
Correct answer: 0.048
Marks for this submission: 0/1.

5
Marks: 1

Let r(t) be the time-t short rate. You re given that

The stochatic process of r(t) is given by $dr(t) = 2\sigma[0.19-r(t)]dt + \sigma\, dZ(t)$ where σ is a positive constant and Z(t) is a standard Brownian motion. The Sharpe ratio of interest risk is 0.1. Let P(r,t,T) be the time-t price of a zero-coupon bond that matures at time T, when the time-t short rate is r.

Find $\lim_{T \to \infty} \ln P(0.03,0,T)/T$. _____

Answer:

Make comment or override grade

Incorrect
Correct answer: -0.115
Marks for this submission: 0/1.

6
Marks: 1

Let P(r,t,T) denote the price at time t of $1 to be paid with certainty at time T, $t \le T$, if the short rate at time t is equal to r. for a Vasicek model you are given:

P(0.08, 4, 9) = 0.6707
P(0.1,8, 13) = 0.492693
$P(r^*, 5,10) = 0.643752$

. Calculate r^*. _____

Answer:

Make comment or override grade

Incorrect
Correct answer: 0.082659
Marks for this submission: 0/1.

7
Marks: 1

You are given that r(t), the short term interest rate at time t, satisfies the follwoing equation:

$$r(t) = r(0)\, e^{-0.032t} + 0.06(1-e^{-0.032t})+0.08\int_0^t e^{0.032(s-t)}dZ(s)$$

where Z(s) is a Brownian motion.
The price of a zero-coupon bond issued at time t and expiring at time T when the short term interest rate is r is denoted by P(r,t,T).
Calculate $P_r(0.04,0,4.9)/P(0.04,0,4.9)$. _____

Answer:

Make comment or override grade

Incorrect
Correct answer: -4.5352

Marks for this submission: 0/1.

8
Marks: 1

The short-rate process _____ in a Cox-Ingersoll-Ross model follows $dr(t) = [0.009 - 0.09r(t)]dt + 0.1\sqrt{r(t)}\, dZ(t)$, where $\{Z(t)\}$ is a standard Brownian motion under the true probability measure. For $t \le T$, let $P(r,t,T)$ denote the price at time t of a zero-coupon bond that pays 1 at time T, if the short-rate at time t is r. You are given:

- The Sharpe ratio takes the form $\varphi(r,t) = c\sqrt{r}$.
- $\lim_{T \to \infty} 1/T \ln[P(r,0,T)] = -0.08253$ for each $r > 0$.

Find the constant c. {#0.267000:0.013350}

Answer:

Make comment or override grade

Incorrect
Correct answer: r(t)
Marks for this submission: 0/1.

9
Marks: 1

In a Cox-Ingersoll-Ross model for the short rate, $q(0.032, 2, 6) = 0.928$. Determine $q(0.055, 4, 8)$. _____

Answer:

Make comment or override grade

Incorrect
Correct answer: 1.2166
Marks for this submission: 0/1.

10
Marks: 1

Let $r(t)$ be the short rate at time t. You are given:

- The stochastic process of $r(t)$ is $dr(t) = [0.3-0.5r(t)]dt + 0.15\sqrt{r(t)}dZ(t)$, where $Z(t)$ is a standard Brownian motion under the true probability measure.
- The Sharpe ratio of Z is of the form $\varphi(r,t) = c\sqrt{r}$.
- $\varphi(0.03,0) = 0.4$.
- Let $P(r,t,T)$ be the price at time t of a zero coupon bond paying 1 at time T, when the short rate at time t is r. Then $P(0.03,0,4) = 0.0183$ and $P(0.11,0,4) = 0.0137$.
- The stochastic process for the bond price process is $dP(r(t),t,T)/P(r(t),t,T) = \alpha(r(t),t,T)dt - q(r(t), t, T)dZ(t)$.

Find $\alpha(0.06,0,4)$. _____

Answer:

Make comment or override grade

Incorrect
Correct answer: 0.1352
Marks for this submission: 0/1.